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IS 12467-1 (2006): Textiles - Assessment of the Ignitability of Upholstered furniture, Part 1: Ignition source : smouldering cigarette [TXD 32: Textiles Protective Clothing]

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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”



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भारतीय मानक

वस्त्रादि — सौफासाजी के फर्नीचर की ज्वलनशीलता का आकलन

भाग 1 ज्वलन स्रोतः सुलगती सिगरेट

(पहला पुनरीक्षण)

Indian Standard

TEXTILES — ASSESSMENT OF THE IGNITABILITY OF
UPHOLSTERED FURNITURE

PART 1 IGNITION SOURCE: SMOULDERING CIGARETTE

(*First Revision*)

ICS 13.220.40;97.140

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Part 1) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textile Division Council.

The ignitability of upholstered composites for seating for furniture depends to a large extent on the design and materials employed in a piece of furniture. The tests carried out on these component materials in isolation may not give true indication of their behaviour when combined with other component materials in a piece of furniture. Therefore to evaluate the ignitability of an item of seating, it is necessary to test the complete finished item of furniture. However, in view of very wide range of designs and materials employed, the method prescribed in the standard has been chosen to test upholstery materials combined together with other component materials to give information regarding the ignitability properties of assemblies that might be used in a number of different circumstances.

The standard IS 12467 : 1988 "Method for determination of the ignitability of upholstered composites for seating for furniture by smokers' materials" was based on BS 5852 — Part 1 : 1979 'Fire tests for furniture — Part 1 : Methods of test for the ignitability by smokers' materials of upholstered composites for seating'. Since this standard covers ignitability using only smokers' materials whereas there may be other source of ignition which may cause fire in upholstered furniture. Therefore in order to keep pace with the technological advances in the ignitability requirement of upholstered furniture, a need has been felt to revise IS 12467 and widen the scope by covering other sources of ignition corresponding to a match flame equivalent.

Therefore, two parts of the standard have been brought out. This standard is based on EN 1021-1 : 1993 and covers ignition source as smouldering cigarette. The other part in the series is:

Part 2 Ignition source: Match flame equivalent

The composition of the Committee responsible for formulation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounding off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TEXTILES — ASSESSMENT OF THE IGNITABILITY OF UPHOLSTERED FURNITURE

PART 1 IGNITION SOURCE: SMOULDERING CIGARETTE

(First Revision)

1 SCOPE

1.1 This standard (Part 1) prescribes a test method to assess the ignitability of material combinations, such as covers and fillings used in upholstered seating, when subjected to a smouldering cigarette as an ignition source.

1.2 The test measures only the ignitability of a combination of materials used in upholstered seating and not the ignitability of a particular finished item of furniture incorporating these materials. They give an indication of, but cannot guarantee, the ignition behaviour of the finished item of furniture.

2 DEFINITIONS

For the purposes of this standard, the following definitions shall apply.

2.1 Progressive Smouldering — Exothermic oxidation, not accompanied by flaming, that is self-propagating, that is independent of the ignition source. It may or may not be accompanied by incandescence.

2.2 Flaming — Undergoing combustion in the gaseous phase with the emission of light.

3 CRITERIA OF IGNITION

3.1 Progressive Smouldering Ignition

For the purpose of this standard, all types of behaviour mentioned below are considered to be progressive smouldering ignitions:

- any test assembly that displays escalating combustion behaviour so that it is unsafe to continue the test and active extinction is necessary;
- any test assembly that smoulders until it is essentially consumed within the test duration;
- any test assembly that smoulders to the extremities of the specimen, namely upper or lower margins, either side or to its full thickness, within the duration of the test;
- any test assembly that smoulders for more than 1 h; and

- any test assembly that, on final examination (see 9.3), shows evidence of charring other than discolouration, for more than 100 mm in any direction apart from upwards from the nearest part, of the original position of the source.

NOTE — In practice it has been found that there is usually a clear distinction between materials which may char under the influence of the ignition source but which do not propagate further (non-progressive combustion) and those where smouldering develops in extent and spreads (progressive combustion).

3.2 Flaming Ignition

For the purpose of this standard, all types of behaviour mentioned below are considered to be flaming ignitions:

- any test assembly that displays escalating combustion behaviour so that it is unsafe to continue the test and active extinction is necessary;
- any test assembly that burns until it is essentially consumed within the test duration; and
- any test assembly on which any flame front reaches the lower margin, either side or passes through its full thickness within the duration of the test.

4 PRINCIPLE

To subject an assembly of upholstery materials to a smouldering cigarette ignition source. The assembly is arranged to represent in stylized form a junction between a seat and back (or seat and arm) such as might occur in a typical chair. The ignitability of an assembly is determined by applying smoker's materials such as a cigarette. The test method measures the ignitability of the overall composite of materials, that is cover(s), interliner, infill material, etc, as constructed on the test rig. The results shall not be stated as being applicable to the general behaviour of any individual component (see also Annex A).

5 HEALTH AND SAFETY OF OPERATORS

5.1 General

The test method specified in this standard presents a considerable hazard; therefore suitable precautions shall be taken.

5.2 Enclosure

For safety, the test should be conducted in a non-combustible fume cupboard. If such a cupboard is not available, a test enclosure should be constructed (see 6.2) so that the operator is protected from the fumes.

5.3 Extinguishers

Adequate means of extinguishing the assembly should be provided, bearing in mind that some combinations may produce severe flaming during the test. A hand and/or fixed water spray which can be directed over the burning area can be useful. Other means such as fire extinguishers (water and halogenated hydrocarbons), fire blankets and a bucket of water will assist.

In some cases smouldering may be difficult to extinguish completely and complete immersion in water may be necessary.

6 APPARATUS

6.1 Test Rig

6.1.1 A suitable test rig is illustrated in Fig. 1 and Fig. 2. It shall consist of two rectangular frames hinged together and capable of being locked at right angles to each other.

6.1.2 The frames shall be made from nominal 25 mm × 3 mm steel flat bar and shall securely hold mesh steel platforms set 6 ± 1 mm below the top edge of the frames (mesh size should be such that an open mesh area of approximately 15 to 150 mm² exists).

6.1.3 The internal width and height of the back frame shall be 450 ± 2 mm × 300 ± 2 mm and the width and depth of the base frame 450 ± 2 mm × 150 ± 2 mm. A standard edging section may be used around the mesh steel platform to give protection and greater rigidity.

6.1.4 The sides of the frame shall extend beyond the back of each frame to provide for the hinge holes and to form the back legs. The hinge rod shall be of nominal 10 mm diameter steel, continuous across the back of the rig and its axis 22.5 ± 0.5 mm beyond the back member of each frame.

6.1.5 The frames shall be lockable at right angles by a bolt or pin through each of the pairs of members forming the back legs. The front legs may be welded across the front corners of the base frame. The height of the legs shall be such as to leave a gap not less than 50 mm high between the base and frame and the supporting surface.

6.1.6 For the tests the rig shall be sited within the

enclosure (see 5.2) and the testing shall be performed in a basically draught-free environment permitting an adequate supply of air and removal of smoke from the area of the apparatus.

6.2 Test Enclosure

The test enclosure shall consist of either a room with a volume greater than 20 m³ (which contains adequate oxygen for testing) or a smaller enclosure with a through flow of air. Inlet and extraction systems providing an air flow rate of less than 0.2 m/s in the locality of the rig provide adequate oxygen without disturbing the burning behaviour.

6.3 Clock

The clock shall be capable of measuring to at least 1 h with an accuracy of 1 s.

6.4 Ignition Source: Smouldering Cigarette

6.4.1 An untipped cylindrical cigarette complying with the following requirements shall be used:

- a) Length: 70 ± 4 mm,
- b) Diameter: 8 ± 0.5 mm, and
- c) Mass: 1 ± 0.1 g.

6.4.2 The smouldering rate shall be 12.0 ± 3.0 min/50 mm, when tested as per 6.4.2.1.

6.4.2.1 Mark the cigarette, conditioned as described in 7.1 at 5 mm and 55 mm from the end to be lit. Light it as described in 9.2 and impale it horizontally in air (air flow rate less than 0.2 m/s) on a horizontal wire spike inserted not more than 13 mm into the unlit end. Record the time taken to smoulder from the 5 mm to the 55 mm mark.

7 ATMOSPHERES FOR CONDITIONING AND TESTING

7.1 Conditioning

7.1.1 Prior to conditioning described below, all outer cover materials shall be subjected to the water soaking and drying procedure as described in Annex B.

7.1.2 The materials to be tested and the cigarettes shall be conditioned for at least 16 h immediately before the tests in the following atmosphere:

- a) Temperature: 27 ± 2°C
- b) Relative humidity: 65 ± 2 percent

7.2 Testing

The test shall be carried out in an atmosphere having a

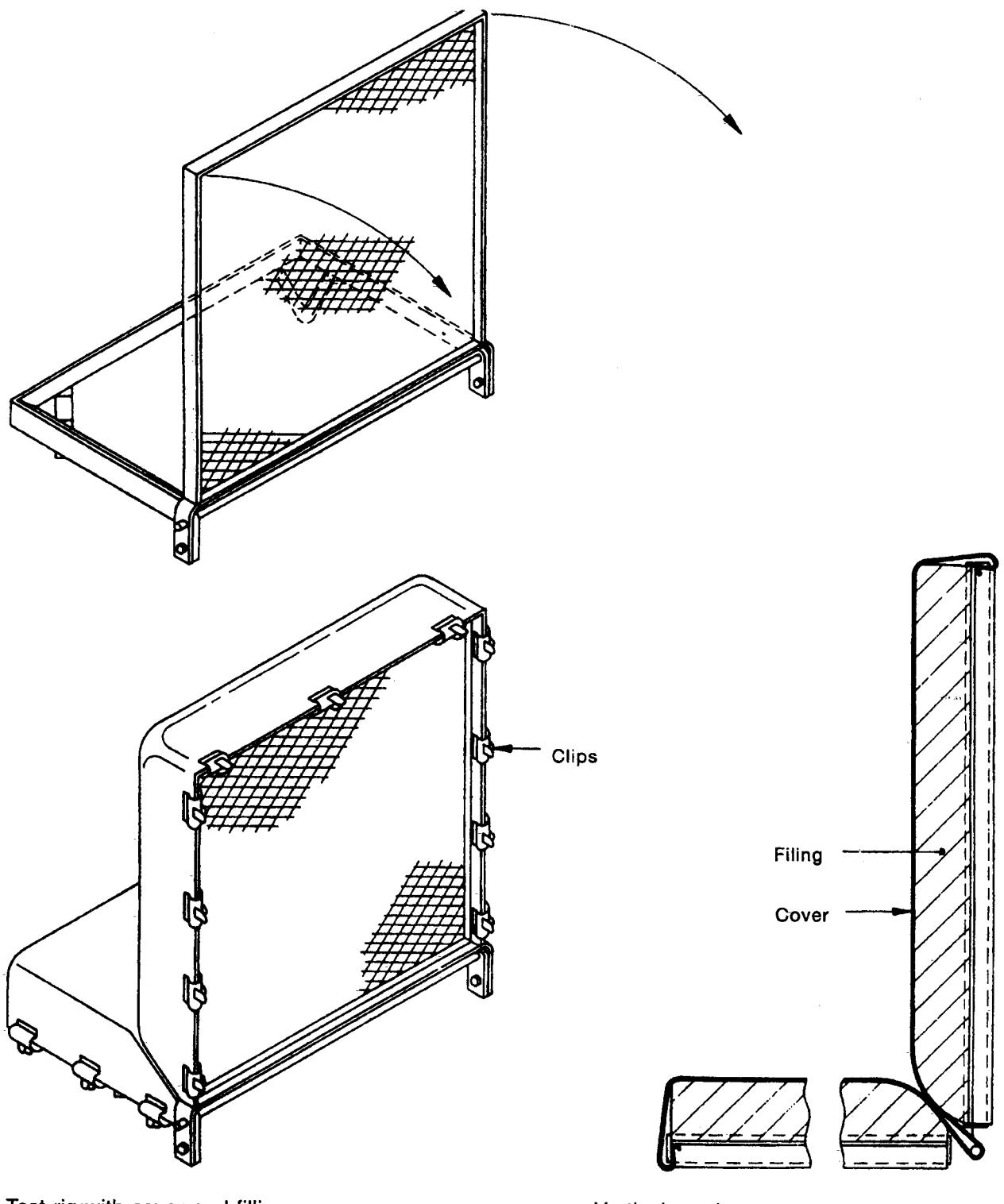
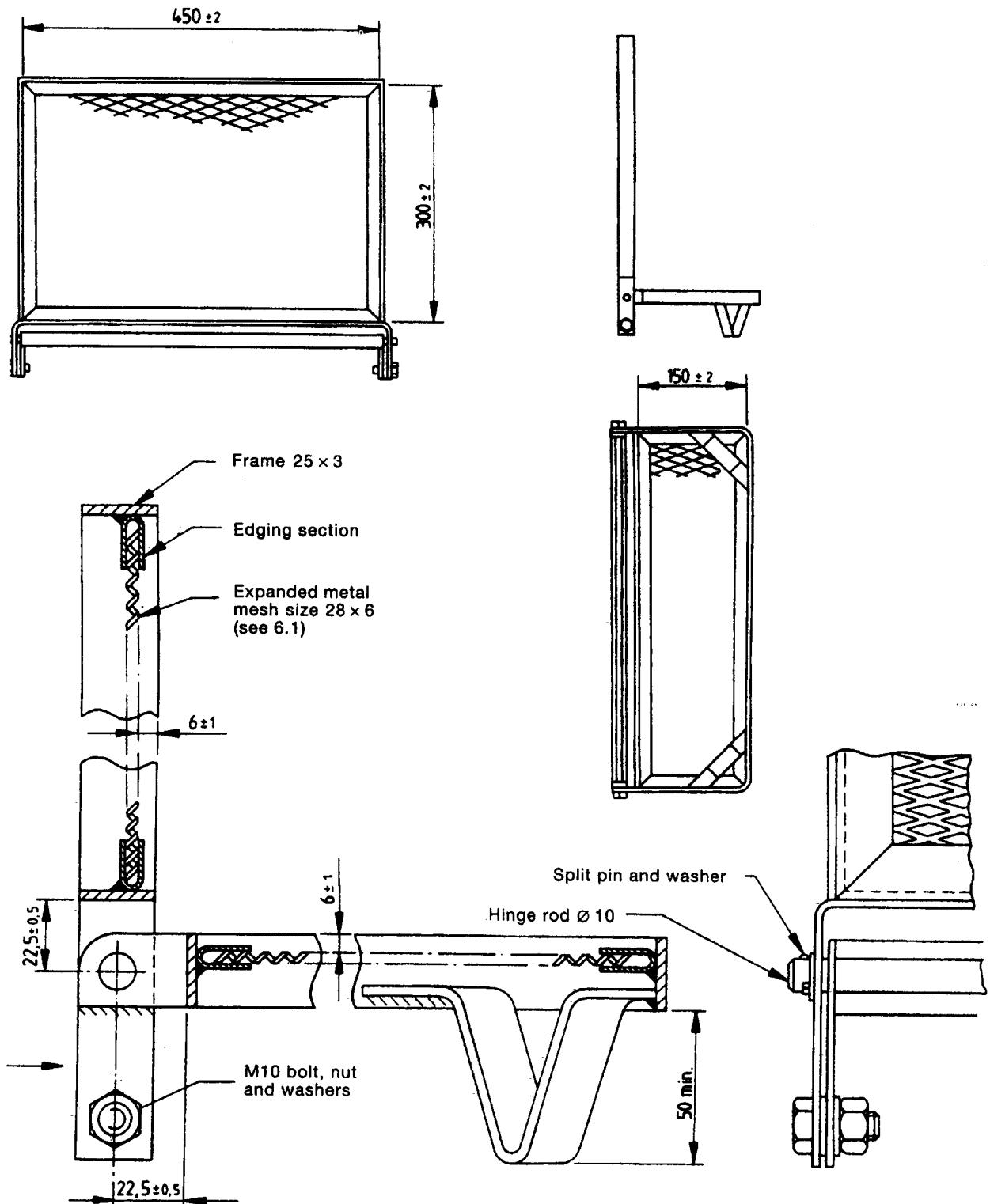


FIG. 1 TEST RIG ASSEMBLY



NOTES

- 1 Unless tolerances are indicated, dimensions are nominal.
- 2 All parts are made of steel.

FIG. 2 TEST RIG DETAIL

temperature between 10°C and 30°C and a relative humidity between 15 percent and 80 percent.

8 TEST ASSEMBLY

8.1 General

The test assembly materials shall be representative samples of the cover, filling and other components such as any interliner which may be used in a real assembly.

NOTE — The test assemblies may be made up with identical materials in the horizontal and vertical sections.

8.2 Cover Material and Interliner

8.2.1 The cover size needed for each test shall be

$$800^{+10}_{-0} \text{ mm} \times 650 \text{ mm}^{+10}_{-0} \text{ mm}$$

8.2.2 The long dimension shall be cut parallel to the machine direction. The cover may be constructed from smaller pieces of material, provided that the location of the resulting seams does not occur within 100 mm of the area likely to be affected by the test.

8.2.3 The cover shall have cut-outs 325 mm from one end on both sides. The cut-outs shall be positioned so that when assembled on the test rig, the lay of the pile is down the back assembly and from the hinge to the front of the base frame. The size of these cut-outs shall be approximately 50 mm base width \times 100 mm height \times 25 mm top width.

8.2.4 Where fabric interliner is used, it shall be cut to the same dimensions, and in the same orientation as the cover, for fitting to the test rig under the cover.

8.3 Upholstery Filling

8.3.1 Two test assemblies are necessary for each test, with the following dimensions:

- a) one piece (450 ± 5) mm \times (300 ± 5) mm \times (75 ± 2) mm thick; and
- b) one piece (450 ± 5) mm \times (50 ± 5) mm \times (75 ± 2) mm thick.

8.3.2 Some cushioning assemblies may consist of several layers that may be typically felt, wadding or different foams. Where the total thickness exceeds 75 mm, reproduce the upper 75 mm of the cushioning assembly except that the upper layer(s) shall not be continued over and round the edges of the assembly.

8.3.3 Where the filling is less than 75 mm thick, the test assembly shall be built up to the required thickness by adding a further layer of the bottom material to the underside.

8.3.4 Some kinds of loose packing materials (for example, foam crumb, feathers) may be evaluated by this test method. In these cases the loose packing shall be built up beneath the covering materials to reproduce the 75 mm thickness of the assembly at a realistic packing density. Where necessary, a finer grid material or air-porous fabric may be laid over the expanded metal of the test rig to retain the filling.

8.3.5 If the loose infill is enclosed in an interlining (or ticking), it is acceptable to make up two bags of the interlining suitably filled and to the overall dimensions given above for use as the upholstery filling beneath the cover(s).

8.3.6 The method is unsuitable and cannot be used with composites where the loose infill material flows out of the assembly during the test and either extinguishes, moves, or adversely affects the burning of the ignition source.

9 TEST PROCEDURE

9.1 Preparation

9.1.1 Open out the test rig and thread the cover fabric and fabric interliner, if any, behind the hinge bar.

9.1.2 Place the filling samples under the covering fabric, locating them in the frame recesses.

9.1.3 Allow a 20 mm overlap on the inside of the frame, and fasten the fabric over the top, bottom and sides using clips.

NOTE — This action places the cover under some tension and it may be found easier to carry out if the frames are folded together to compress the upholstery partially.

9.1.4 Ensure that the fabric is secure and under even tension. Then lock the frames at right angles by the bolts or pins.

9.2 Ignition Source Application

9.2.1 Light a cigarette and draw air through it until the tip glows brightly. Not less than 5 mm and not more than 8 mm of the cigarette shall be consumed in this operation.

9.2.2 Position the smouldering cigarette along the junction between the vertical and horizontal test assemblies so that the cigarette is not less than 50 mm from the nearest side edge or from any marks left by any previous test and simultaneously start the clock.

9.2.3 Observe the progress of combustion and record any evidence of progressive smouldering or flaming in the interior and/or cover.

NOTE — The detection of smouldering may be difficult and is eased by watching for smoke emerging at points at a distance from the cigarette. Smoke is most easily viewed by looking down a rising column by means of a mirror.

9.2.4 If progressive smouldering ignition (*see 3.1*) or flaming ignition (*see 3.2*) of the upholstery components is observed at any time within 1 h of placing the cigarette, extinguish the test assembly and record this, together with the time elapsed between placing and extinguishing. In these circumstances discontinue testing and complete the test report (*see 10*).

9.2.4.1 If progressive smouldering ignition or flaming ignition is not observed, or if the cigarette fails to smoulder its complete length, record this and repeat the test with a new cigarette placed in a fresh position not less than 50 mm from any previous test damage. If progressive smouldering, ignition or flaming ignition is not observed in this retest or if the cigarette fails to smoulder its complete length, record this and carry out the final examination (*see 9.3*).

NOTES

1 If preferred this repeat test, may be carried out concurrently with the first test.

2 Test rig should be kept clean to ensure that test assemblies do not become contaminated with the residues left from earlier tests (*see Annex C*).

9.3 Final Examination

Cases of progressive smouldering ignition undetected from the outside have been reported. Immediately after completion of the test programme on the assembly, dismantle it and examine it internally for progressive smouldering ignition [*see 3.1 (e)*]. If this is found, extinguish the test assembly, and record a failed result for the relevant test source. For safety reasons ensure that all smouldering has ceased before the rig is left unattended.

10 TEST REPORT

The test report, of which the form shown in Annex D is an example, shall give the following information:

- a) Reference to this part of the standard;
- b) Whether ignition occurred in each test. If only two tests have been run yielding one ignition and one non-ignition, the overall result is taken as ignition; and
- c) If ignition occurred, whether it was progressive smouldering ignition or flaming ignition, and the measurements or observations relevant to the criteria for ignition.

ANNEX A

(Clause 4)

GUIDANCE NOTES FOR DESIGNERS AND SPECIFIERS (INFORMATIVE)

A-1 This standard lays down methods for examining the ignitability, in defined circumstances, of an assembly of upholstery materials. These materials are combined together in a way intended to be generally representative of their end use in upholstered seating and the ignition sources are selected so that most may be related to everyday sources.

A-1.1 Thus the potential ignitability of a particular cover, filling and interliner in combination can be assessed.

A-1.2 However, there are two important limitations, as follows:

- a) The tests are concerned only with ignitability and any controls of fire hazard have to consider, in addition, other aspects of fire performance such as rate of fire development, heat output, rate and quantity of smoke production and toxic gas evolution. Ideally, any attempts to reduce ignitability ought not to affect these other properties adversely.
- b) The limitation detailed in 1 occurs because design features of the furniture can greatly affect its fire properties, any ignitability tests of a piece of furniture would therefore need to be carried out on the actual item and not on component materials or mock-ups. However, limited information on ignitability, more specifically related to an intended design, may be obtained as indicated in A-2 and A-3.

A-2 All ornamental edging and other decoration shall be removed from the material to be tested.

A-2.1 If an item of furniture does not have an upholstered back and upholstered arm rests, the materials in the test rig shall be mounted as if the item had an upholstered back composed of the same material as used in the seat.

A-2.2 If an item of furniture has an upholstered back and upholstered arm rests, but not an upholstered seat, the material in the test rig shall be mounted as if the item had an upholstered seat composed of the same material as used in the back or arm rests. This applies if the seat is in contact with the upholstered parts of the back or arm rests. If a part (seat, arm rests or, back) of an item of furniture is upholstered and covered in a different material from that used in the rest of the item of furniture, each part shall be tested as if the entire item of furniture had been upholstered and covered with these materials. This does not apply to upholstered parts that have been tested already.

A-2.3 If decorative seams or stitches are included as part of the design of the fabric, at least one such seam shall be included in each test. The seam shall be placed so as to cross the intersection between seat and back at an approximate right-angle, and shall be placed so as to be located at least 50 mm from the nearest edge. The ignition source shall be placed so that it crosses the seam at the angle between seat and back.

A-3 This part of the standard lays down laboratory tests for an assembly of materials which will give general guidance on the ignitability of finished furniture, but where more specific information is required, for example tip-up seats or in critical areas of end use, the principles may be applied to complete items or sub-assemblies of furniture or to suitably modified test-assemblies, some examples of which are given below. In such cases the source described in 6.4 may be applied at positions which, as a general rule, correspond to those where the hazard of ignition occurs in use.

Example 1

If a chair has a gap between the seat and back cushions, the placing of ignition sources in the angle of the test apparatus is inappropriate. Instead, face ignition, where the source is placed on the horizontal and vertical surfaces, is more meaningful.

Example 2

The test apparatus may be used to model the junction of any vertical and horizontal surfaces so that both arm and back constructions, if different, may be tested separately in conjunction with the seat.

Example 3

The use of different materials in a back and seat of a chair may be reproduced in the test, two different cover fabrics being joined by sewing or with staples behind the hinge bar.

A-4 The ability of a cover material to provide protection against ignition can be indicated by testing it in a combination with a substrate of known flammability. Similarly, the role of a filling can be established by using it in conjunction with covers with different types of behaviour. Such information about the individual materials does not eliminate the need to test the actual combination, but it can help in the short-listing of material combinations and so reduce the overall amount of testing required.

ANNEX B
(Clause 7.1.1)

WATER SOAK PROCEDURES (INFORMATIVE)

B-1 REAGENTS

B-1.1 Water

B-1.1.1 A supply of water with a degree of hardness of 8-10 dH (80-100 mg/l CaO).

B-1.1.2 If the water is harder than 10 dH, demineralized water shall be added until the required degree of hardness is achieved. The quantity of demineralized water to be added to 1 litre of water with a degree of hardness D (>10 dH) is (D-9)/9 litres.

Example: To 5 litre water with a degree of hardness 13.4 dH, $5 \times (13.4-9)/9 = 2.44$ litre demineralized water shall be added to obtain 7.44 litre water with a degree of hardness of 9 dH.

B-1.1.3 If the water is softer than 8 dH, salts shall be added in order to increase the hardness. Two solutions shall be prepared:

a) *Solution I*

Dissolve 3.91 g calcium chloride ($\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$) in 1 litre demineralized or distilled water.

b) *Solution II*

Dissolve 3.00 g sodium bicarbonate (NaHCO_3) in 1 litre demineralized or distilled water.

The quantity of these two solutions to be added to 1 litre water of a degree of hardness of D (<8dH), is : 12.2 (9-D) millilitres.

Example: To 10 litre water with a degree of hardness 7.0 dH, $10 \times 12.2 (9-7) = 244$ ml of solution I and an

equal amount of solution II shall be added to obtain 10.488 litre water with a degree of hardness of 9 dH.

B-1.2 Wetting Agent

Any non-ionic wetting agent.

NOTE — The exact nature of this reagent is not critical.

B-2 APPARATUS

Flat bottomed dish of sufficient size to enable the test specimens to be completely immersed.

B-3 SPECIMENS

Use sufficient cover material to permit subsequent preparation of test specimen of the dimensions described in 8.2.

NOTE — Depending on the dimensions of the flat bottomed dish (see B-2) the specimen may require folding.

B-4 PROCEDURE

B-4.1 Using a liquor ratio (sample mass : water mass) of 1 : 20, completely immerse each specimen in water (see B-1.1) containing 0.5 g/l of non-ionic wetting agent (see B-1.2) in the flat bottomed dish (see B-2) at an initial temperature of $40 \pm 1^\circ\text{C}$. Ensure the specimen remains completely immersed.

B-4.2 After 30 min, remove the specimen, rinse in the water (see B-1.1) using a liquor ratio of 1 : 20 for 2 min and then dry the specimen by any method suitable for the fabric type. If the specimen has been folded during immersion, refold before rinsing.

ANNEX C
(Clause 9.2.4.1)

CLEANING OF RIG

C-1 It is important that the rig should be kept clean to ensure that test assemblies do not become contaminated with the residues left from earlier tests. It is particularly important that the hinge bar should be kept clean. This may be facilitated by using a hinge bar which can be removed to minimize contamination as well as to aid cleaning. A hinge bar which is held in place by split pins has been found to be acceptable.

C-2 Cleaning of the test rig can be done with solvents or by burning the residues off the rig. Care needs to be taken to ensure that the rig does not become distorted when removing residues by burning. When solvents are used, care should be taken to prevent test assemblies becoming contaminated with solvents. Normal safety procedures should be followed, particularly when flammable and/or toxic solvents are being used.

ANNEX D
(Clause 10)

MODEL REPORT FORM

Issuing Authority :	Test No.
.....	Sample :
	Date :
	Company :

Test Report in accordance with IS 12467 (Part 1) (confidential)

Assessment of ignitability	:	Ignition source	:	Smouldering Cigarette
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Material tested

Test results (Non-ignition, smouldering ignition, flaming ignition):

Sl No.		<i>Cigarette</i>		<i>Comments</i>
		1	2	
	Smouldering Criteria			
i)	Unsafe escalating combustion [3.1(a)]	*	*	
ii)	Test assembly consumed [3.1(b)]			
iii)	Smoulders to extremities [3.1(c)]			
iv)	Smoulders through thickness [3.1(c)]			
v)	Smoulders more than 1 h [3.1(d)]			
vi)	More than 100 mm from source [3.1(e)]			
	Flaming Criteria			
vii)	Unsafe escalating combustion [3.2(a)]			
viii)	Test assembly consumed [3.2(b)]			
ix)	Flames to extremities [3.2(c)]			
x)	Flames through thickness [3.2(c)]			

*Enter 'YES' if criteria exceeded or 'NO' if criteria not exceeded.

Signed

(Any extraordinary events should be reported overleaf)

NOTE — The above test results relate only to the ignitability of the combination of materials under the particular conditions of test; they are not intended as a means of assessing the full potential fire hazard of the materials in use.

ANNEX E

(Foreword)

COMMITTEE COMPOSITION

Chemical Methods of Test Sectional Committee, TX 05

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Central Institute for Research on Cotton Technology, Mumbai	DR (KUMARI) C. R. RAJE DR R. H. BALASUBRAMANYA (<i>Alternate</i>)
Central Pollution Control Board, Delhi	DR M. Q. ANSARI SHRI AJAY AGGARWAL (<i>Alternate</i>)
Clariant (India) Ltd, Mumbai	DR V. G. NAYAK
Directorate of Standardization, Department of Defence Production & Supplies, New Delhi	LT COL (DR) R. SHRIVASTAVA LT CDR B. MANJUNATH (<i>Alternate</i>)
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Indian Jute Industries' Research Association, Kolkata	SHRI N. C. SOM
Jayshree Textiles, Rishra	SHRI ABHEY NAIR SHRI Pawan SHARMA (<i>Alternate</i>)
L. N. Chemical Industries, Mumbai	SHRI KETAN L. GANDHI
Maniklal Verma Textile Institute, Bhilwara	DR N. K. MATHUR
Man-Made Textile Research Association, Surat	DR SANDEEP R. NAIK SHRI M. G. PATEL (<i>Alternate</i>)
Ministry of Defence (DGQA), New Delhi	SHRI P. P. NAIDU SHRI RAMA YADAV (<i>Alternate</i>)
Ministry of Defence (R&D), New Delhi	SHRI S. C. JAIN
Office of the Textile Commissioner, Mumbai	SHRI R. A. LAL
Rajasthan Spinning & Weaving Mills Ltd, Bhilwara	MAJ GEN V. BADHWAR SHRI VIJAY YADAV (<i>Alternate</i>)
Reliance Industries Ltd, Mumbai	SHRI P. K. BADAMI SHRI SANJEEV ISRANI (<i>Alternate</i>)
SNDT Women's University, Mumbai	DR (Ms) BHARATI A. PATWARDHAN
Suditi Industries Ltd, New Bombay	SHRI R. CHINRAJ SHRI RAJENDRA GAIKWAD (<i>Alternate</i>)
Sunil Industries Ltd, Mumbai	SHRI VINOD G. LATH SHRI RAMESH KHANNA (<i>Alternate</i>)
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The Bombay Millowners' Association, Mumbai	SHRI MAHESH SHARMA
The Bombay Textile Research Association, Mumbai	SHRI A. V. AFFINI SHRI B. S. ACHARYA (<i>Alternate</i>)

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Tex-n-Lab, Thane	SHRI ULLAS NIMKAR SHRI S. V. RDARAJAN (<i>Alternate</i>)
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